



## HAWAII COOPERATIVE EXTENSION SERVICE

College of Tropical Agriculture and Human Resources

University of Hawaii

GENERAL HOME GARDEN SERIES No. 4

### FERTILIZER FOR THE HOME GARDEN

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Plants require certain nutrients to grow properly, and if any of these nutrients are lacking in the soil, they must be added through the use of fertilizers. The fertilizer may be natural, synthetic, organic, inorganic or chemical, or any combination of these.

Nutrients required by plants are classified as major (or primary), minor (or secondary), and micro-nutrients (or trace elements), based upon the relative amount required and not by importance. If any one of these elements is lacking, the plant cannot grow and produce as it should.

#### How Plants Use Nutrients

Plants take up their nutrients as ions: each compound or material added to the soil breaks down (or dissolves) in the soil solution into ions, which are then absorbed by plant roots and translocated to the parts of the plant where they are needed. The plant cannot distinguish between sources of nutrients, so as long as it receives an adsorbable ion, it does not matter if you use natural, organic, or chemical fertilizers. It is true, however, that organic materials require more time for the breaking down process than the chemical materials, primarily because they must undergo decomposition by soil microorganisms before they are available to the plant.

Soils that are too acid or alkaline will affect the breakdown of fertilizers into ions, and other unfavorable conditions—poor aeration, soils that are too wet or too dry, restricted root systems, too much salt, weather that is too cool, too much organic residue in the soil, and so forth—will also reduce the availability of nutrients to plants.

#### Sources of Plant Nutrients

Nitrogen, phosphorus, and potassium are the major nutrients, and most fixed fertilizers will contain two or more of them. The amount contained in the fertilizer is expressed by a series of numbers, such as 10-30-10, 21-53-0, or other similar set of numbers: the first figure is the percentage of nitrogen (N) in

the mixture; the second is the percentage of available phosphoric acid ( $P_2O_5$ —or the oxide equivalent of the phosphoric acid); and the third is the percentage of water-soluble potash ( $K_2O$ —or the oxide equivalent of the potassium). The secondary elements are calcium (Ca), magnesium (Mg), and sulfur (S), and they are often found in the fertilizer mixtures for the major nutrients or in carriers. Iron (Fe), zinc (Zn), copper (Cu), manganese (Mn), boron (B), and molybdenum (Mo) are the micro-nutrients.

Various types of compounds, called “carriers,” contain the plant nutrients. Frequently these compounds are known as straight materials also. Urea, for example, is a carrier for nitrogen. Some carriers may contain more than one plant nutrient; diammonium phosphate, for instance, contains both nitrogen and phosphorus. The carriers for the various nutrients are often mixed together to produce mixed fertilizers.

A mixed fertilizer containing nitrogen, phosphorus, and potassium is known as a “complete” fertilizer. Most mixed fertilizers are called “commercial” fertilizers, although, in fact, any fertilizer mixture or material sold by one person or firm to another is a commercial fertilizer.

“Natural” fertilizer materials—rock phosphate, potassium chloride, and Chilean sodium nitrate, for example—occur in nature, are processed and then sold. Materials originating from plants and animals and those containing carbon other than in the carbonate ( $CO_3$ ) form are called “organic” fertilizers and are generally poor sources of phosphorus and potassium. Plant and animal sources, such as tankage, manure, bone meal, and wood ashes are “natural organics.” Urea and calcium cyanamid, “synthetic organics,” are made by combining nitrogen, which is fixed from the air, with carbon compounds to form organic compounds. All other sources are generally classified as “inorganic” or

“chemical” fertilizers because they are manufactured from nitrogen, which is fixed from the air; treated with acids or other materials to make them more available for plant use; or treated to remove unwanted impurities.

#### **Effect of Fertilizers**

The major advantage of using natural organic fertilizers is the humus formed after decomposition which has a great effect upon soil structure. Humus increases the water-holding capacity of the soil, increases the nutrient-holding capacity, which reduces fertilizer losses through leaching, and improves tilth, which makes it easier for plant roots to extend through the soil. It provides nitrogen—but little phosphorus and very little potassium. The addition of natural organic materials to the soil does not prevent weed growth or plant diseases, nor does it protect against insect attacks. Organic fertilizers do not have any marked influence upon the nutritive value of crops grown on the soil over the same amount of plant food from chemical fertilizers.

Chemical fertilizers supply greater quantities of plant nutrients through a minimum amount of carriers. They contain the plant nutrients in forms more quickly available and necessary for plant use. Where needed, they increase plant growth and yields because they supply the particular nutrient or nutrients required in the quantity required at the time required. Where needed and properly applied in

required amounts, chemical fertilizers do not injure the soil, increase disease or insect injury, reduce weed growth, or have a marked influence upon the soil's nutritive value over the same amount of plant food from organic sources. Chemical fertilizers do not poison vegetables or other plants, and they do not destroy animal life in the soil. They do provide the plant and animal life in the soil with the necessary nutrients for their growth.

Best results are obtained when soil organic matter is maintained by adding the necessary amounts of organic residues, such as compost, manures, sewage sludge, and so forth, and when chemical fertilizers of the correct analysis are applied properly at the correct rate to supply the nutrients needed by the crop to be grown.

Soil tests are the best means of determining the nutrient requirements for the plant to be grown.

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**NOTE:** The use of trade names is for the convenience of readers only and does not constitute an endorsement of these products by the University of Hawaii, the College of Tropical Agriculture and Human Resources, the Hawaii Cooperative Extension Service, and their employees.

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